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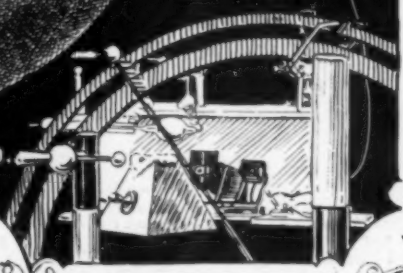
THE AMERICAN X-RAY JOURNAL

A MONTHLY DEVOTED TO THE PRACTICAL APPLICATION OF THE NEW SCIENCE AND TO THE PHYSICAL IMPROVEMENT OF MAN.



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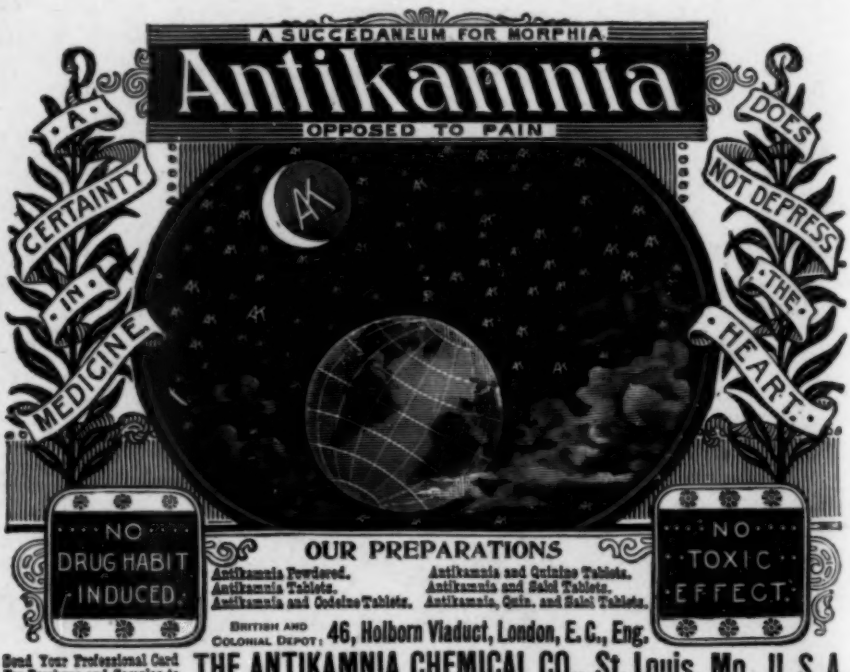
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A PRELIMINARY REPORT ON A METHOD OF OVERCOMING HIGH RESISTANCE IN CROOKES' TUBES; A POSSIBLE STEP TOWARD MAXIMUM RADIANCE.

BY WM. W. GRAVES, M. D., ST. LOUIS, MO.

S. H. Monell, in his "Manual of Static Electricity in X-Ray and Therapeutic Uses," makes the following observation:

"I maintain that the tube can not be made too good for general work. The utmost penetration that can be secured still falls far short of what is sometimes to be desired. There are a thousand tubes in actual use which are too poor to give satisfaction while there is one which is doing fine work, and tubes which are too penetrating must as yet be placed in the same category as nuggets of gold which are too big. Anybody can cut down penetration to any low point he wishes by acts which are as simple as the turn of the hand, but to reach a high point of penetration, is one of the things which still puzzles almost every operator."

Whether for fluoroscopic or cathodographic work, approaching maximum radiance is always to be desired. A tube which gives only fair radiance has little practical value, other than from development by usage it may attain high efficiency.

Maximum radiance is sought by all operators of x-ray apparatus, but up to the present moment, the means of securing radiance approaching the maximum have been uncertain, on account of the difficulty in readily overcoming resistance in high efficiency tubes. High resistance in tubes that have at one time afforded radiance is due to but one cause—usage. So far, no tube has been constructed that is as constant as the incandescent lamp. Every user of Crookes' tubes is daily reminded of their variability. The state within the tube fluctuates from day to day, until from more or less usage, a tube which in the beginning gave off good rays will, in course of time, offer so much resistance that the discharge will no longer readily pass through, and by persisting in the use of the tube the resistance becomes so great that by every heretofore known means

of "coaxing," it is no longer possible to overcome it.

"One of the most practical matters which can concern the operator in x-ray work is the question of getting the current through the tube when the resistance becomes too high." (Monell.)

The heretofore described and most readily accessible methods of overcoming high resistance are as follows: (A) Application of heat from alcohol lamp. (B) "Making bridge with hand between cathode and reflector. (C) Coating terminals with tin-foil beginning at wires and extending over arms of tube until they begin to expand into the central bulb." (Monell.) I should also mention, baking tube in an oven of moderate temperature, boiling in oil, and lastly, setting the tube aside for rest for a few days or weeks.

"Finally, when the process becomes difficult, and the result unsatisfactory, the tube can be exhausted again." (Monell.)

"At last a point is reached when even heating with a flame—so far as is consistent with safety—fails to reduce the vacuum and again the tube is useless and must be sent to be re-exhausted." (Wm. J. Morton, "The X-Ray," p. 118.)

"As the resistance of the tube continues to increase with use it will gradually exceed the power of the coil. It should then be opened, attached to the pump and once more exhausted. The resistance may be temporarily reduced by warming the tube for some time before using it, or by running the current for a few minutes in the opposite direction. Various other expedients may be adopted, but it should be clearly understood they restore the activity of the Crookes' tube for a short time only." (David N. Walsh, "Roentgen Rays in Medical Work," p. 30.)

"With each time of heating the subsequent usefulness of the tube becomes less and less until, finally, no further work can be obtained from it. The only recourse when that time arrives is to have it re-exhausted by the manufacturer." (William H. Meadowcroft, "The A. B. C. of the X-Rays," p. 126.)

Of course if the tube rises so high in vacuum that no discharge can be sent through it there is nothing to do but to have it re-exhausted, unless it is a tube of the adjustable vacuum kind, in which case the vacuum can be lowered in a few seconds." (Same author, p. 154.)

Frederick Strange Kolle in his work, "The X-Rays" (p. 124) after speaking of the methods of heating, baking and boiling, says: "The last means of all is to have it retubed—to have it opened, the air let in, and again exhausted by the vacuum pump until it gives off the rays so much desired."

In a letter dated February 8, 1898, from Messrs. Van Houten & Ten Broeck, makers of the type of tube employed in my experimental work, it is stated: "That if all the methods set forth in Dr. Monell's book for the controlling of the vacuum in the tube fail we can offer no further suggestion and would advise that tubes be sent to the maker for re-exhaustion."

All authors, users and makers practically agree that if the various procedures for the control of vacuum as engendered by usage fail, there is but one thing to do—have the tube re-exhausted. If one has a large stock of tubes on hand, and a tube becomes somewhat rebellious, and demands rest, another of lower resistance may be used. If one has only a few tubes, and is doing much work, he soon finds that his tubes have become unmanageable and will require either rest or re-exhaustion.

Now if it is a fact, and experience so teaches, that the greater the resistance, as afforded by the vacuum tube, the higher will be its efficiency when the resistance is overcome, it must follow that

approaching maximum radiance will not be attained until it is possible to overcome all resistance. Therefore, those tubes that are set aside for rest, and those tubes that are returned to makers for re-exhaustion, are the very tubes which if their resistance can be successfully overcome, are capable of affording the nearest approach to maximum radiance.

If there were a way of overcoming the resistance in such tubes, approaching maximum radiance would be the rule, and not as now, rarely seen. I believe there is a way, but it is not found by using tubes which have regulating devices, for in such tubes no sooner does the radiance begin to approach the maximum than its penetration is lowered by the use of the "extinguisher." In fact, may not the trouble be in improper manipulation of the tube and current, and not in the tube?

It is difficult to believe that the vacuum actually increases or that so long as a tube remains intact that it may, from usage, become incapable of affording radiance. The incandescent lamp is a vacuum tube, not nearly so high as the Crookes' tube it is true, but the difference as far as vacuum is concerned is one of degree only. The incandescent lamp may be used repeatedly until some part of its mechanism gives way, then why not the Crookes' tube? With such thoughts for a working basis, unhampered by theories, but with a firm determination not to give tubes rest or to have them re-exhausted, I have experimented with so-called dead tubes.

In order that an approach to maximum radiance may be obtained it is necessary to have efficient generating apparatus, and to keep it in condition to practically generate its maximum output of current at all times. An inefficient generating apparatus and a high efficiency tube are incapable of producing any kind of radiance. It is also necessary to be perfectly familiar with the care and management of the apparatus and to have some knowledge of technique in current and tube manipulation. Technique may be acquired by proper instruction, study and observation, but after all, personal experience is the best teacher. If any one doubt the truth of the old maxim, "There is no true excellence without great labor," he may soon become convinced of it after a short experience with rebellious Crookes' tubes.

The generating apparatus employed by me is an eight-plate, thirty-inch Morton-Wimshurst-Holtz Influence Machine, operated by a one-fourth horse power Crocker-Wheeler motor. This report is based upon experimental work with this apparatus; but the principles upon which this report is founded will apply, I presume, to coils, though I have had no personal experience in that direction.

The tube used in actual as well as experimental work is known as the "Monell Static Tube." Tubes of this kind are strong, well made, have a wide radius of action and are probably as near perfection as any tube on the market. I have found but one fault with the Monell tube and that is common to nearly all tubes—I refer to air-bubbles in the glass, particularly of the bulb. Air bubbles are, undoubtedly, weak spots in the tube, and affording less resistance, puncture may ensue. I have recently had the misfortune to puncture two very fine tubes, and in both instances puncture took place through an air bubble in the bulb. Had proper care been exercised this would not have occurred, but it did occur, and I have modified my method of manipulation so that however careless one may be it will not occur again. I have written to the makers and asked if it is possible to avoid air bubbles in tube construction. Being weak spots, all else being equal, the fewer the bubbles, the stronger the tubes.

The Monell Static Tube is said to be

exhausted by true pump exhaustion to about one-millionth of an atmosphere. Like all tubes, if used often, radiance increases with resistance until a point is reached when the current will no longer readily pass through. By resorting to the heretofore mentioned methods, the resistance may be temporarily overcome. If the use is persisted in, the resistance soon becomes so great that all heretofore known procedures fail. The tube is then said to be "dead" and to require rest; rest failing, re-exhaustion.

Such a tube "Is not dead, but sleeping," so to speak, as I have demonstrated in my experimental work time and again, and when aroused is capable of affording radiance exceeding its former penetration and brilliancy—radiance—one step nearer the maximum.

My experimental work confirms me in the belief that success in reviving dead tubes will depend, not upon the carrying out of one, but of all of the following essentials: (1) An efficient generating apparatus capable of generating its maximum output of current. (2) Correct method of operating tube and proper use of current interrupters. (3) Reversal. (4) Application of tin-foil.

APPLICATION OF TIN-FOIL.

Early in January, 1898, one of my tubes died—that is to say, after trying every accessible method save rest, baking and boiling, the discharge could not be gotten through. While the machine was in full operation a piece of tin-foil, which I held in my hand, fell upon the tube in such a manner as to form a bridge from within one-half inch of cathode terminal wire to a point on bulb about midway between cathode and anode. Immediately, the tube glowed with brilliant radiance. On removing the foil, the glow died out; on replacing it, the glow returned. I noticed at this time that a fine brush discharge, intermingled with a few sparks, was taking place between the cathode terminal wire and the foil, and that from the other end, in contact with bulb, fine, forked, radiating discharges were taking place, spreading over the bulb in every direction from margin of foil, the discharges being thicker at the margin, growing thinner a short distance away, and finally disappearing. See Plate I. On placing the foil in similar position to anode end of tube, no glow was obtainable; but on placing it on cathode end, the glow returned. I observed further on this occasion that if the foil were allowed to remain in position for a short time it might be removed and the glow would continue, but if I now placed the foil to anode end of tube, the glow died out. By taking two strips of foil, and placing one at cathode end and the other at anode end of tube, no glow was obtainable. These experiments seemed to indicate that the tube was not yet dead, and so far did not require rest or re-exhaustion; that by the application of foil to cathode end of tube, the resistance would be seemingly lessened; that by similarly applying it to anode, the resistance would be apparently increased, and that by applying it to both ends, no effect on resistance was noticeable.

Further experiments have so far confirmed what seemed to be true as far as the proper position for application of foil is concerned, but I soon found that increasing resistance from continued use had become so great that the application of foil alone would not overcome it.

I have tried a great many ways of applying foil to cathode end of tube. My first method was to have a bridge and clasp constructed from imitation whalebone covered with foil, and attached to the tube as shown in Plate I. I took the precaution to have one terminal of bridge so constructed as to fit accurately the convexity of the bulb so that even contact would be assured; likewise, the portion of bridge which was to rest upon arm of tube near the cathode terminal

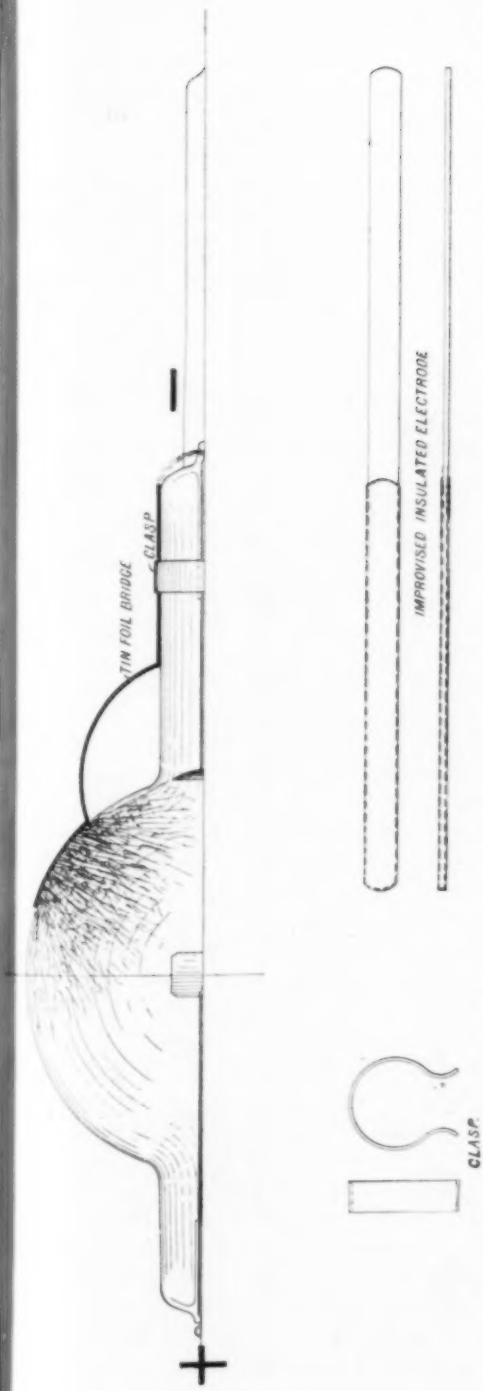


PLATE I.

wire. This precaution was taken on account of fear of puncture from the discharge taking place at a possible point of imperfect contact with the bulb. The bulb being thinner than the arm, and having more air bubbles, rendered this precaution necessary. As bulbs vary in size and convexity, it was necessary to have a bridge and clasp for each tube. The puncturing of the two tubes before mentioned was due to my carelessly applying bridges that did not conform to the convexity of the bulbs, but rested on the bulb, in each instance, at distal end of bridge, thus making imperfect contact. The concentrated discharge taking place at point of contact, in both instances happening to be over a bubble, punctures ensued. This unfortunate accident, I am positive, would not have occurred had I used bridges making close contact with bulb. The only reason for using the whale-bone bridge in applying foil to tube was that when clasped in position, it would not fall off in turning the tube in holder.

Since puncturing these tubes, I have adopted the plan of either clasping a strip of foil of several thicknesses on tube, with two clasps on arm, one being near the cathode disk and the other near the cathode terminal wire, or of gluing in a similar manner such a strip to arm and bulb. See Plate II. The latter method makes perfect contact, avoids all possibility of puncture by reason of close contact, and for the further reason that the glass is thicker and has fewer bubbles at portion of tube to which the foil is now applied. A useful accessory is a piece of whale-bone about ten inches long, one-half of which is coated with foil. It answers the purpose of an insulated electrode, and by its use, unpleasant sparks are avoided in tin-foil and current manipulation.

METHOD OF OPERATING TUBE, AND USE OF CURRENT INTERRUPTERS.

I invariably employ what is known as

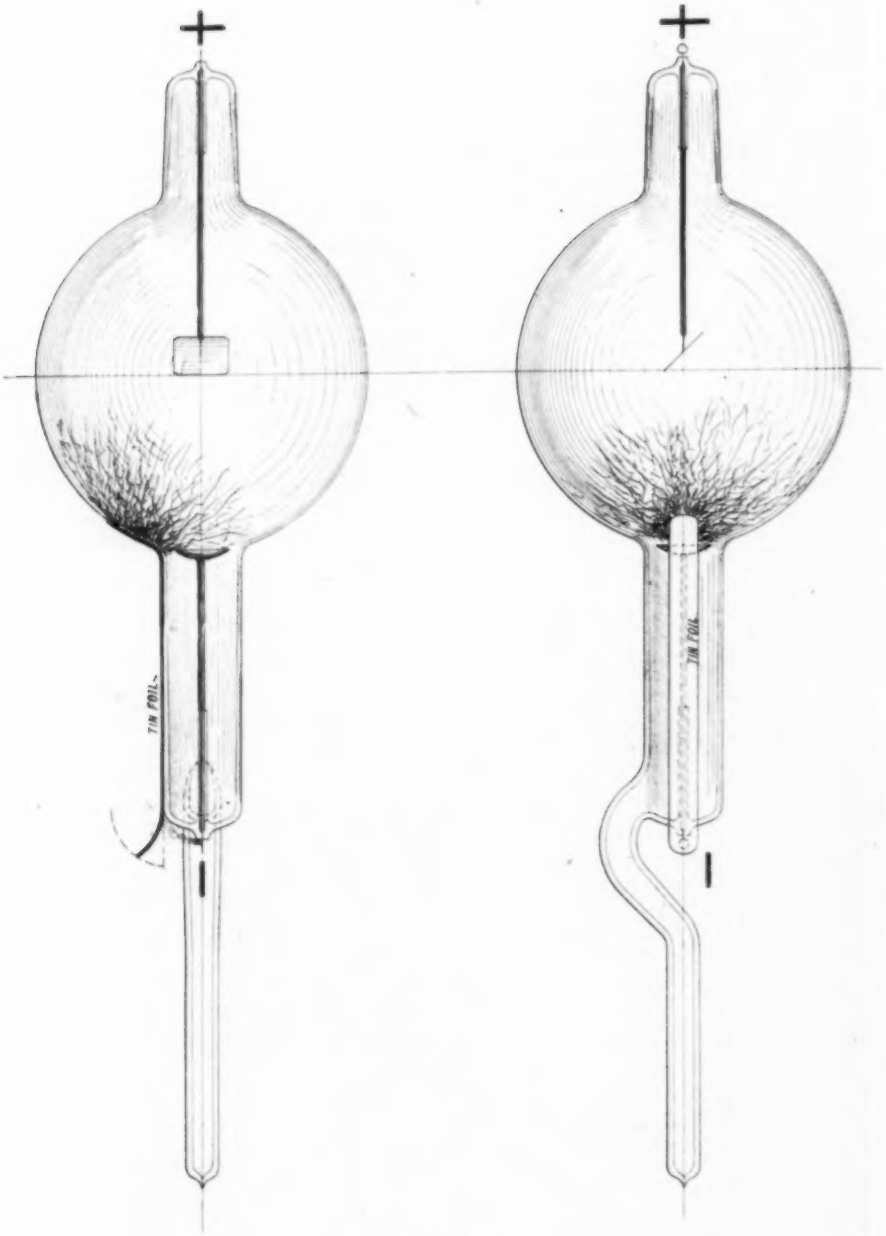


PLATE II.

the "Convective Method with Current Interrupters," as described in S. H. Monell's work, p. 134.

Whether for a tube of low or one of high resistance, this method answers every purpose. It is non-heating and is almost noiseless, and under proper conditions, the glow of the tube in action is practically as steady as incandescence.

"Monell's Improved Current Interrupters" are extremely useful devices to users of static apparatus, and in attempting to overcome high resistance are indispensable. Monell says of them: "They will make a tube of moderate efficiency do good work more quickly and with less trouble than any other way." In this statement I most heartily concur, and I will say further, that if properly employed, they will contribute more to success in overcoming high resistance—all things being equal—than any one thing.

I have observed a difference in effect produced on tube resistance by the interrupting of either the positive or negative discharge. In any case, if the radiance is satisfactory the interrupters should not be used. Either one, or both, should be used for a specific purpose, for under certain conditions, by using the one or the other, resistance may be increased or diminished. In a tube of low resistance the use of either, or both, will seemingly increase its efficiency. In a tube of ordinary resistance—that is to say, one which will back up a spark gap of from one to two inches, as described in Monell's work p. 125, interrupting the discharge at positive pole appears to increase the efficiency of the tube more than by interrupting the discharge at the negative pole.

In a tube the resistance of which has become so great from usage that the discharge will no longer readily overcome it, only the interrupter at negative pole should be employed. In my experimental work, I have observed repeatedly that if the interrupter at positive pole be employed, resistance will increase rapidly, so that the discharge will not pass through; whereas, if the interrupter at negative pole is employed, resistance is seemingly lessened and the tube will often glow.

The preceding statements are intended to apply to tubes when resistance has not gotten beyond the point of control by the various measures heretofore employed by others for overcoming high resistance. In working with tubes whose resistance has become so great that they are believed to be dead, and to require re-exhaustion, it may be stated positively, as far as the use of interrupters is concerned when the tube is connected positive to anode, and negative to cathode, that if necessary, the interrupter in contact with negative pole should alone be employed. When a tube is working in an ideal manner, that is, with neither interrupter in action, great care should be exercised, that from the vibrations of the machine the interrupters in contact with poles do not become separated, causing slight spark gaps. Should this occur at positive pole, causing a spark gap of one-half inch or less, the glow in the tube may suddenly cease.

On interrupting the negative discharge at cathode terminal wire with the foil, as well as at the pole of the machine, the negative discharge is seemingly intensified, so that internal resistance may be overcome which could not be overcome by interrupting the discharge at either point alone. A spark gap, a brush discharge, either or neither, may be readily had between cathode terminal wire and foil, by shifting the position of the foil up or down, and by varying the length of spark gap at negative pole. The effect on tube resistance is greater with a spark gap between foil and terminal wire, and less with brush discharge, the foil having no effect when neither is passing. The ideal glow in a

tube is to be found when nothing save the whirl of the plates can be heard; and the interrupting of the discharge at negative pole and cathode terminal wire should be done, only for the purpose of attaining the ideal. From the foregoing considerations, the conclusion may be drawn, *that by interrupting the positive discharge on its way to the tube internal resistance is increased, and by interrupting the negative discharge internal resistance is lessened. If, on the other hand, the tube is connected positive to cathode, and negative to anode, that is to say, reversed, the converse of the foregoing conclusion holds good.*

REVERSAL.

With apparatus generating its maximum output of current, by correctly manipulating foil on arm of tube near cathode terminal wire, and with proper technique in the use of current interrupters, one may be able to overcome resistance heretofore believed to be impossible; but until the tube is reversed, and the discharge in passing through the tube reversed, shows in a satisfactory manner the phenomena peculiar to reversal, all possible resistance, as engendered from usage, will not have been successfully overcome. Reversal is, therefore, one of the essentials for success. In the course of my experiments I have encountered tubes whose resistance was so great, reversed, that for a time it was seemingly impossible to overcome it.

There is considerable difference in the degree of resistance in tubes reversed and of those properly connected. A tube of ordinary resistance, properly connected, will back up a spark gap of from one and a half to two inches; reversed, not more than one-half inch. My investigations seem to indicate that the resistance is about three times as great, positive to anode, and negative to cathode, as it is reversed. This being the case, when the resistance, reversed, shows the test of a six-inch spark gap between the poles, without the discharge going through the tube, its enormous resistance, properly connected, may be readily appreciated. This degree of resistance was developed *by usage* and *by improper use of current interrupters* and the difficulties encountered in overcoming it were due to the latter cause. For a long time I was successful in securing the necessary phenomena in the tube reversed by employing the interrupter at the negative pole and by the use of tin-foil attached to anode end of tube, until from so doing, for a time, it was no longer possible to get the discharge through, reversed. When I corrected the error, by interrupting the positive discharge at both machine and tube, the resistance, reversed, was readily overcome.

In observing the phenomena peculiar to a tube of low resistance reversed, and comparing it to one of high resistance reversed, several differences were apparent. It occurred to me that if these differences are brought about by usage, the causing of the discharge to pass through in a reversed manner until the phenomena in a high resistance tube would resemble, in certain particulars, the phenomena observed in a tube of low resistance, reversed, it would indicate the proper degree of reversal and at the same time help to solve the question of the heretofore believed high vacuum barrier as engendered by usage.

In fact, both objects are accomplished by reversal. If the discharge is made to go through reversed until the phenomena resembles in certain particulars that seen in a tube of low resistance, and if the tube then be properly connected, it will usually glow with most brilliant radiance; if it does not, by slight assistance, readily obtained by interrupting the negative discharge at pole with interrupter, and if necessary, further intensifying the discharge by interrupting it with the foil near cathode terminal wire.

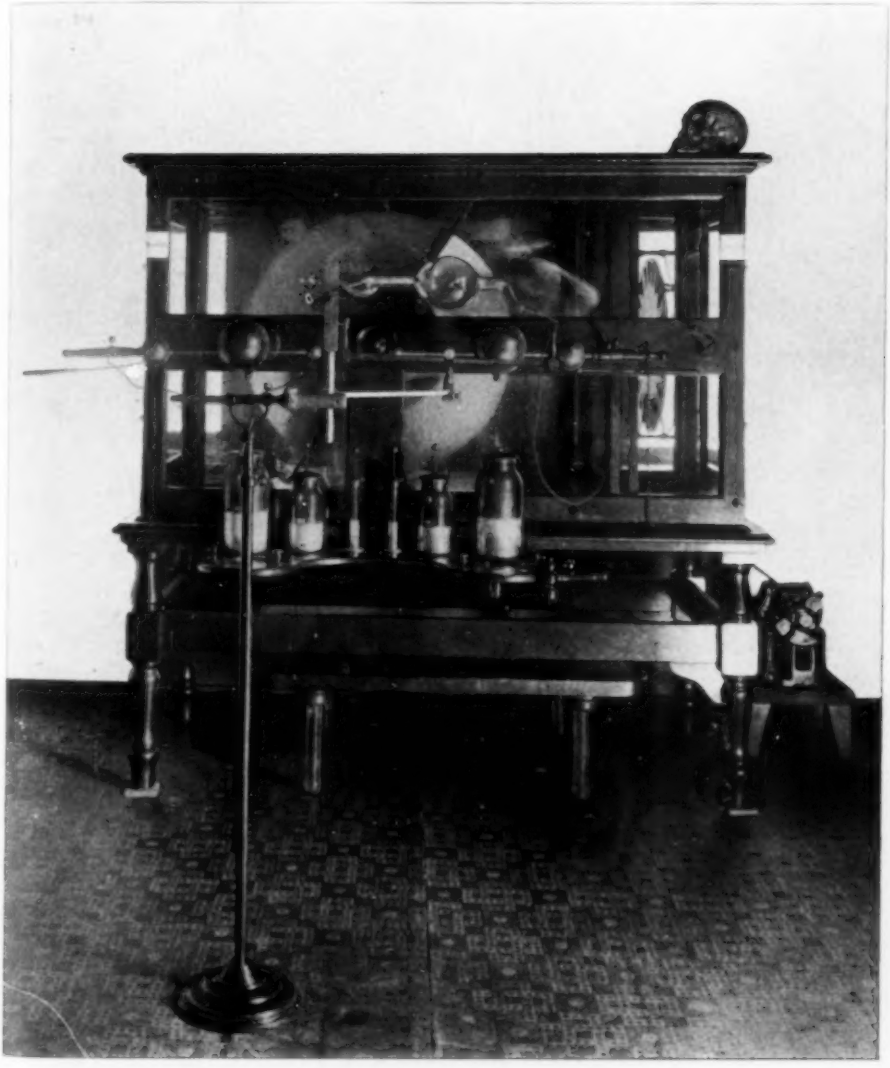


PLATE III.

Author's apparatus in operation. Showing tin-foil on cathode portion of tube. Interrupting the discharge at negative pole with interrupter—as well as at cathode terminal wire with "foil"—to lessen resistance in the tube properly connected.

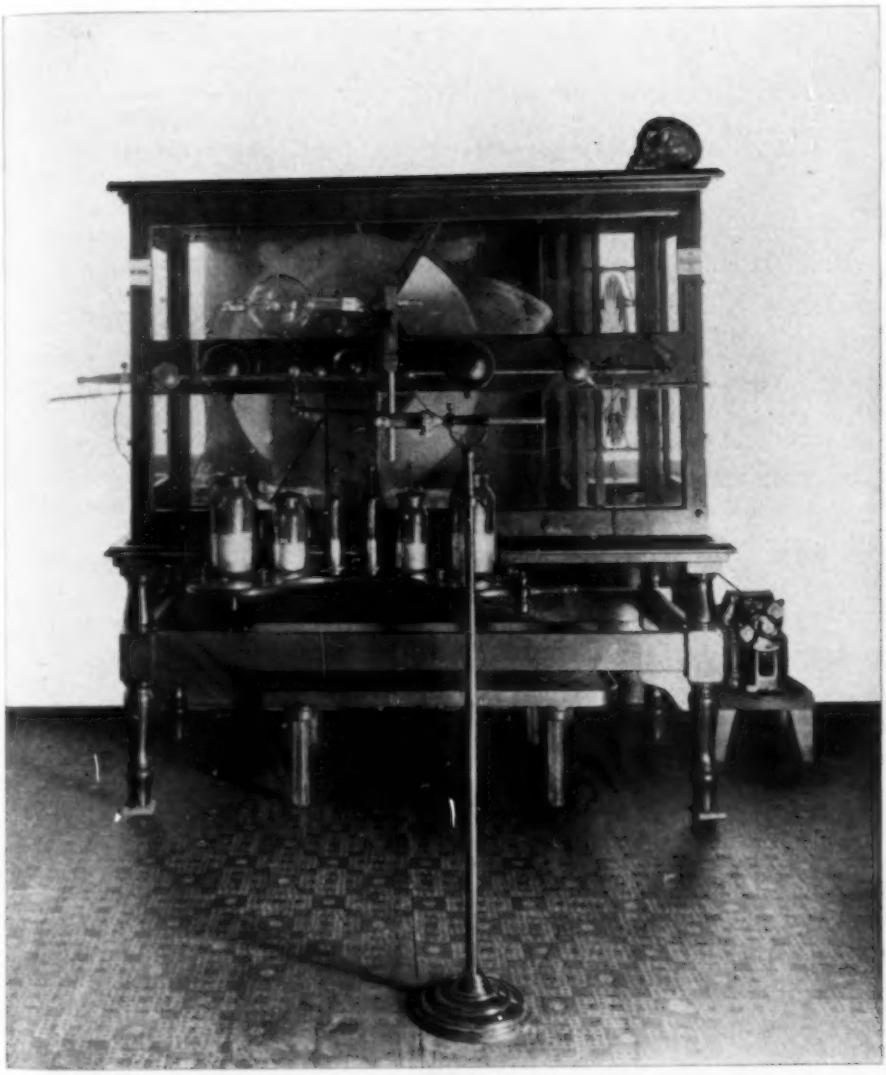


PLATE IV.

Author's apparatus in operation. Showing Crookes' tube in "Reversal," and the use of interrupter at positive pole, interrupting the positive discharge to secure "the phenomena peculiar to reversal"—"to overcome in a satisfactory manner resistance in the tube reversed."

the tube will be rendered most docile and obedient.

It may, therefore, be stated as a working proposition: *It being possible to overcome in a satisfactory manner resistance in the tube reversed, it should also be possible to do so in the tube properly connected.*

If the tube in action presents an ideal condition, so does the tube reversed, and in both instances that ideal is *constancy*. The phenomena peculiar to a tube of ordinary resistance, in reversal, anyone may study for himself, and a description in words at this time is not necessary. Suffice it to say that in the overcoming of the heretofore believed unconquerable resistance as engendered by usage, the discharge should be made to pass through in the reversed manner until the glow is constant, and until the arrangement of striae in anode end of bulb resembles, as nearly as possible, that arrangement observed in a tube of ordinary resistance reversed, particularly until those spots which may often be seen in varying positions in bulb are driven back and are absorbed, so to speak, by the striae from which they may have originated. When these spots have been driven back, disappear and become a part of a normal arrangement of striae, when the glow has become constant, when in a tube of *advanced* development it shows steady radiance as may be demonstrated by the fluoroscope, the proper degree of reversal has been attained. *If the tube be now properly connected, and by the use of interrupter and foil, if necessary, the heretofore believed dead tube will demonstrate that it still lives. Remembering, as we must, its early radiance, and beholding as we do now its present degree of development, may we not believe we are one step nearer the maximum?*

From the difficulties encountered in attempting to overcome resistance in the tube reversed; from observing the phenomena peculiar to reversal in low as well as high resistance tubes, and by taking into account the preceding considerations, based upon personal experimental work, I am thus early in my investigations forced to believe, *that success in overcoming the heretofore believed high vacuum, as engendered by usage, will depend upon proper technique in current and tube manipulation; that the trouble is not in the tube per se; that a Crookes' tube which has once afforded radiance should continue to do so as long as its electrodes are not disintegrated or its vacuum destroyed; that the so-called high vacuum, as engendered by usage, is most likely a myth; that a tube which has once afforded radiance requires neither baking, boiling, rest nor re-exhaustion; that the longer a tube is used the greater it grows in efficiency; that usage is to the Crookes' tube what the crucible is to crude gold; that maximum radiance has never been seen, and that the way to maximum radiance may possibly be found in the overcoming of the heretofore believed impassable barrier of resistance, thus assuring continued development in tube life.*

I have purposely refrained from giving particulars as to the degree of tube development so far attained, nor is it, at this time, incumbent upon me to do so. If the user of x-ray apparatus will cast aside his tube of the adjustable vacuum kind, and will use only *one* tube until from development by usage it begins to approach the maximum, I shall be satisfied to let him tell the story.

How soon the maximum, the goal of all investigators, will be attained, no one knows. Then, as now, all honor be to him whose discovery is the crowning triumph of the age, to him who pointed out the way to use that unknown and as yet unknowable light, to him who gave mankind the power to view with human eye the heretofore invisible; all honor, all praise, all glory be to him—Doctor William Konrad Roentgen.

1943 North Eleventh Street.

The Relation Between the Outlines of the Internal Organs of the Body As Determined By the X-rays and By the Phonendoscope. The Laws Governing the Two Methods.

BY PROF. DR. AURELIO BIANCHI. (PARMA)

Read at the XV Congress for Internal Medicine at Berlin, 1897.

Those organs whose molecular vibrations in the form of light or sound make no sensible impression upon our sight or hearing without the use of specially constructed apparatus, are at the present time directly appreciable to the eye and the ear, on the one hand by the aid of the x-rays and fluoroscope, and on the other by the aid of the phonendoscope.

Skiascopy, therefore, the science of the x-rays and the fluoroscope, and phonendoscopy, the science of auscultation with the aid of the phonendoscope, are two new and far-reaching methods of studying the condition of the internal organs of the body both in health and disease; but these methods are still in their infancy.

Neither the vibrations of the cathode rays nor the sound-waves produced in the various organs of the body are appreciable to the eye or the ear, unless the eye be aided by the fluoroscope, and the ear by the phonendoscope.

While, on the one hand, the invisible vibrations of the x-rays penetrate the different viscera of the body with a facility which varies with the shape, density and mutual relations of the latter, and are then made visible in the fluoroscope, or are fixed upon a photographic plate, so on the other hand, the friction of the finger-tip across the surface of the body gives rise to vibrations which are inaudible to the most acute ear, but which are taken up and intensified by the phonendoscope, and so rendered distinctly audible. In this way the phonendoscope outline of any desired organ may be traced upon the surface of the body.

Skiascopy and phonendoscopy are therefore two new clinical procedures which give like results by different methods, the one rendering vibrations sensible to the eye, the other to the ear. Both methods may be made to give permanent results, the former by means of the x-ray photographs, the latter by means of the phonendoscopic chart.

The similarity of these results has led me to look for some constant relation between the two procedures in the hope of coming to some useful and definite conclusions. My efforts were rewarded with the most satisfactory results, and I can say without hesitation that both methods of procedure are governed by the same fundamental laws, and although each has its own peculiarities and variations the results of both are the same.

It was this consideration of the similarity of two methods of investigation so apparently different, one of which was discovered in Germany, the other in Italy, which has afforded me the opportunity of addressing this assembly today. I therefore beg to express my thanks to you for the honor of being present among you, and of being permitted to learn of progress, of new discoveries, of the fruits of investigation and experiment from the lips of the most prominent physicians of the German Empire.

You are well acquainted with the apparatus necessary for skiascopy; permit me to describe the instruments used in phonendoscopy. They are very few, consisting in fact of but one instrument, the phonendoscope. The tip of the finger is used to stroke the skin for the production of the necessary vibrations, and an ordinary lead pencil suffices to draw the outlines of the organs upon the skin.

The phonendoscope was invented at my suggestion about four years ago, and is the work of my colleague, Professor Bazzi. Since that time many imitations

and modifications of the instrument have been made; these are, however, mere variations in the shape of the instrument and not in the principle of its construction.

The phonendoscope consists of the following parts: a large mass of metal having a small air-chamber on one side, which is closed by two vibrating discs; a localizer; rubber tubes and ear-tips;—and no instrument previously invented combined all these peculiarities.

With the aid of this instrument we can examine a large or a small portion of the body-surface with little difference in its sensitiveness. In fact it is just this power, afforded us by the use of the localizer, of examining one very minute portion of the body at a time, which has enabled me to develop a method of investigation which was never dreamed of before.

On account of the extreme sensitiveness of the instrument I have ceased using the forcible vibrations produced by the voice or by percussion, and have learned to utilize instead the very delicate vibrations produced by a gentle stroke of the finger across the skin.

The instrument is manufactured in Germany in the city of Cassel by the firm of Martin Wallach. This house not only manufactures a perfect instrument but spares no pains to distribute the same to all parts of the world.

We now come to the subject proper of our paper.

1. Neither skiascopy nor phonendoscopy cause the patient any pain.

2. Neither the passage of the cathode ray through the body nor the scraping of the finger by which the vibrations for the phonendoscope are produced cause the patient any pain, although the former occasionally gives rise to a burning or crawling sensation, in the skin the latter to an occasional tickling sensation.

3. Neither the fluoroscope, the sensitive photographic plate for the x-ray picture, nor the localizer of the phonendoscope give rise to any other sensation to the patient than that of mere touch. The eye of the observer is apt to become tired after a prolonged examination with the fluoroscope, as is also the ear of the physician using the phonendoscope; but in the latter case the exhaustion is by no means as marked as in the former.

4. In order to make the x-ray shadow in the fluoroscope clear and distinct the instrument must be applied to the body at the point at which the organ to be examined is most superficial. In like manner the phonendoscope must be applied to the surface directly over the desired organ, so as to bring it as far as possible into continuous contact with the organ itself.

5. As the intensity of the x-rays must be adjusted according to the distance of the organ from the surface of the body, so it is also important to regulate both the pressure exerted upon the localizer of the phonendoscope and the force of the strokes by which the necessary vibrations are produced, according to the position of the organ to be examined. Very powerful x-rays will pass through the superficial and less dense structures of the body without producing a shadow; in using the phonendoscope, if too much force be used in stroking the skin the pressure of the finger will increase the tension of the superficial structures and the vibrations will be transmitted to the deeper organs; and if too much pressure be made upon the phonendoscope, the superficial vibrations will be suppressed and only those coming from the deeper organs will be transmitted through the instrument.

6. In using the x-rays it is best to place the bulb opposite the viscus to be examined and the fluoroscope directly over it, or if the viscus be a large one the fluoroscope must be placed upon several different parts of its surface. In

using the phonendoscope, it should likewise be placed directly over the organ at one or more points according to the size of the organ, and the finger producing the vibration should move in a circular manner about the point of contact of the phonendoscope with the body.

7. With both the x-rays and the phonendoscope we may obtain either a temporary result or a permanent record.

8. In the case of the x-rays we may be satisfied with a simple examination of the viscera with the fluoroscope; in the case of the phonendoscope with merely outlining the organs upon the skin.

9. A permanent record can be obtained with either procedure by means of a photographic plate or a camera; but a phonendoscopic chart can be rapidly made if the outlines be drawn upon the skin with copying ink and a copy be made directly upon a sheet of paper.

10. In order to obtain clear and trustworthy results with either the x-rays or the phonendoscope, a thorough knowledge of the processes involved, an impartial judgment and technical skill are presupposed requirements.

11. The outline obtained by either of these two procedures is not an exact representation of the outline of the viscus itself; it represents, rather, in one case the shadow of the viscus upon the fluoroscope, in the other the projection of the viscus upon the surface of the body. The farther a viscus is removed from the surface of the body the more will its representation be modified in various ways. The position of the fluoroscope influences the shape of the shadow. If the fluoroscope is in contact with one part of the body surface, for instance, the anterior surface, the sides of the body and parts of organs situated within the sides will be separated from the fluoroscope by some distance, owing to the oval contour of the body; hence arises a certain amount of distortion of the outline, or a partial or general increase of its size. In the case of the phonendoscope also, the fact that it can be brought to bear upon the superficial surface of the organ only, and not even in actual contact with that, and the fact that the body surface is rounded cause the outline to assume a shape which is not the actual shape of the organ itself.

12. The solid viscera throw a dark shadow upon the fluoroscope, whose intensity depends upon the density and thickness of the viscus. With the phonendoscope it is found that these same viscera give powerful vibrations whose intensity is directly proportionate to the thickness and density of the viscera.

13. The shadow thrown upon the fluoroscope by a solid viscus situated in the posterior part of the body is darker in the center of the shadow and lighter around its margin. With the phonendoscope it is found that this same viscus gives rise to vibrations which are more powerful at the center, where the viscus touches the body wall, while towards its borders, where the viscus is separated from the body wall, the vibrations become less and less intense.

14. Viscera, consisting of one or more cavities containing gas give a brighter projection upon the fluoroscope if the tension of the gas is great; and the greater the pressure of gas in the viscera, the higher will be the pitch of the vibrations in the phonendoscope.

15. In a hollow viscus containing both gas and fluid, the part containing gas will throw a light shadow upon the fluoroscope, the part containing fluid, a dark shadow. In using the phonendoscope the part containing gas can be distinguished from that containing fluid by the fact that the pitch of the vibrations over the gas is higher than over the fluid.

16. Osseous structures throw a very dark shadow upon the fluoroscope, and their vibrations in the phonendoscope

are high pitched. The shadows which any part of the body containing bone throws upon the fluoroscope consists of the shadow of the bone plus the shadow of any organs lying behind the bone; the tone of the vibrations heard in the phonendoscope over a long part is a result of the blending of the vibrations peculiar to the bone with the vibrations from the underlying structures. The shadow thrown upon the fluoroscope by an organ enclosed in a bony cavity is almost entirely obscured by the darker shadow of the bone; in like manner the phonendoscope is unable to detect the vibrations due to such organs on account of the predominance of the more powerful bony vibrations.

17. The movements of the various viscera, whether physiologically or artificially produced, can be distinctly seen in the fluoroscope by the motion of their shadows, provided, of course, that the x-ray bulb and the fluoroscope remain stationary. In the case of the phonendoscope, if the point of origin of the vibrations and the situation of the instrument are fixed, any change in the position of the underlying viscera can be determined by a change in their outlines as traced upon the skin. But such movements can be seen in the fluoroscope in a limited number of organs only, such as the bones, the diaphragm, the heart and the lungs, whereas the phonendoscope can be used on any part of the body and upon any viscus or part of a viscus, and upon accumulations of fluid in the different cavities of the body.

18. If a viscus of a certain thickness and density lie directly behind another of the same density, their shadows will be superimposed upon the fluoroscope and the result will be a single dark shadow;—on the other hand, with the phonendoscope we are able to differentiate such viscera and to outline them separately upon the surface of the body with as much facility as if they were transparent. This is accomplished by examining the superficial viscus first and then the deeper one. It is important in this case to apply the phonendoscope at a place where the superficial viscus comes into direct contact with the body wall.

19. A solid viscus or a viscus filled with fluid, situated behind a hollow viscus, will throw a lighter shadow upon the fluoroscope in proportion to the thickness of the hollow viscus. In using the phonendoscope the vibration of the solid viscus will likewise be found weaker, the greater the thickness of the intervening layer of air.

20. If the wall of a hollow viscus be thickened at any point the shadow of the viscus will be less intense at the thickened point, for at this point the layer of air will be less deep or even absent altogether. In the phonendoscope the vibrations over the thickened area will be much more powerful than over the rest of the organ.

21. Finally, by using two Roentgen bulbs and two fluoroscopes, corresponding organs of two individuals can be examined and compared at the same time. In like manner, two observers using two phonendoscopes, can examine simultaneously and compare the vibrations of corresponding parts of two subjects.

From the foregoing it will be seen that these two procedures are not only closely related, but are even somewhat similar; yet the use of the phonendoscope has certain practical advantages which are of special importance to the practicing physician and which are not to be found in the present method of using the x-rays. These advantages are to be found partly in the nature of the apparatus and partly in the clinical application of the instrument.

The instruments required for phonendoscopy are very few. The compact little instrument itself, a lead-pencil, some copying-ink and tracing paper to

make copies of the phonendoscopic chart. The tip of the finger produces the necessary vibrations. The apparatus is portable, and can be used at any time and place.

Clinically, we have already obtained results with the phonendoscope which could not be obtained with the x-rays.

Not only are we able to trace with the phonendoscope the outlines of all the viscera, whether they are situated near the surface or deep in the interior of the body, whether they are solid or hollow or filled with gas or fluid, or even if they are suspended in the interior of a fluid cavity, but it also enables us to locate the subdivisions and ligaments of viscera, to determine all kinds of movements of the organs of the body or alter-

ations of their positions as caused by their functional activity or through the action of gravitation.

Even an incomplete summary of the peculiarities of the phonendoscope, such as can be given at this time must impress both the practicing physician and the scientist with the fact that the instrument affords us a rapid, easy and harmless clinical procedure, by means of which a projection of all the viscera may be traced upon the surface of the body; and that the instrument will become popular and indeed indispensable to those who have studied its use carefully.

The application of the x-rays constitutes a most perfect method of controlling the results of the phonendoscope, and there is no doubt that the x-ray apparatus will be improved in the near future so as to render their application much easier and the results more complete.

We trust that Germany, the home of the x-rays will soon realize this hope, for no problem however complicated can long remain a riddle to German scientists who are ever mindful of the proverb of the Tuscan Academia del Cimento, "Provando e riprovando."

Illustration and translation furnished for publication in the AMERICAN X-RAY JOURNAL by George P. Pilling & Son, Philadelphia, American representatives of the genuine phonendoscope.

RADIOGRAPHY.—Kelsch found in examination of 124 young persons, none with clinical symptoms of pulmonary lesions, that fifty-one were affected with slight abnormalities, decreased transparency of bronchial adenopathy. He suggests fluoroscopy as a valuable aid in determining the pathologic future of the young. Its importance is evident in eliminating young men with a predisposition to tuberculosis in examining for military service. . . . . Vaillant places a sheet of lead between the sensitive plate and its support in radiography of the pelvis, which reduces the time of exposure one-half and renders the negative much more distinct.—*Bull. de l'Acad. des Med.*, Dec. 21.

THEORY OF X-RAYS. ADAM. *Elec. Rev.*, March 9.—An article advancing a theory in reference to the origin and character of x-rays. Accepting Perrin's theory of cathode rays, namely, that some of the molecules of the residual gases are torn into ions, the negative ones flying out with great velocity, the present writer extends the theory to explain x-ray phenomena; supposing the residual gas to be carbonic acid the carbon seek the cathode and the oxygen acquires an enormous velocity, the ions being electrified.—*The Electrical World.*

A BANK OF LAMPS.

BY JOHN T. PITKIN, M. D., BUFFALO, N. Y.

Of all the manifold apparatus placed at the disposal of the progressive electro-therapeutist, by the masters of the greatest branch of modern science, Electrology, not any can compare in point of general usefulness to a properly constructed and correctly manipulated bank of lamps.

Through its skillful employment in connection with the street electrical service and with few accessory instruments all desirable varieties or degrees of electricity both quantitively and qualitatively speaking are obtainable.

In the hands of the electro-medical expert it serves the three-fold purpose of rheostat, converter and galvanometer. Metaphorically speaking it is his "Vade Mecum", an Aladdine lamp, even the goose which lays for him the golden eggs.

But before substantiating the foregoing statements which may seem extravagant and the ground taken in this preamble therefore untenable, let us stop for a moment and consider the manner in which the apparatus should be constructed and its modus operandi in order that we may manipulate it intelligently, knowing why and how it yields this great diversity of electrical currents, for inasmuch as we fail to fathom the intricacies of electrical mechanisms and understand the principles upon which they are constructed, just to that extent we become integral parts of machines, only supplementary to those which the makers see fit to furnish. We raise or lower a plunger, turn a switch or start a rheotome, like the nickel dropped into the slot, we start the apparatus and the machinery does all the rest, the patient is delivered an electrical treatment, so-called, instead of a stick of gum, a prize-fight exhibit or a reproduction of the latest opera; I ask you sincerely, which of them all in your opinion will prove the most beneficial to the sufferer?

RECEPTION ROOM OF BUFFALO ELECTRICAL SANITARIUM.

Assuming that the reader is familiar with the general principles or laws governing the application of electricity to the industries and arts of the present decade, also the manner of wiring buildings for electrical distribution so that he is thus able to trace in his mind's eye, to a given lamp fixture the wires which supply it, should he continue the two wires through a screw-plug placed in the socket usually occupied by a sixteen to thirty-two candle-power lamp, if one of these wires is bent into a loop so that it returns upon itself, that he cuts the distal end and that between the otherwise separated sides of this loop, lamps in their sockets are introduced, by this arrangement he has obtained all the essential features of a lineal bank of lamps.

In order to economize space and facilitate handling, the lamps and conducting wires are attached to a board or marble slab in a serpentine manner and a few accessory devices such as binding-posts, a make and break, a pole changer and a resistance coil are added to complete this most useful of electrical apparatii.

Descriptively the electrician would tersely explain that in the properly constructed bank of lamps, the lamps would be wired in multiple relation with each other, but that the whole group of lamps would be in simple series with the wall-bracket on the one hand and the electrodes and patient on the other.

The electric current which supplies the building, passes from the electrolier, through a bank of lamps on a table in the center of the room, to the various electrical devices.

To the binding posts of ingress to a bank of lamps the wires from a dynamo, wall-bracket or electrolie, (the source of electrical supply) may be attached, while from the posts of egress the properly modified and measured current is conducted to the patient by means of rheophores and electrodes either before

or after still further modification by secondary instruments.

The electro-motor force or voltage of the current taken from a bank of lamps, if not otherwise altered beyond the board, always remains the same, irrespective of the number of lamps turned on, it will therefore correspond in pressure or potential to the electro-motor force of the dynamo which supplies the building with electricity. The amperage, current strength or volume on the other hand will raise or fall as each additional lamp is placed in or out of the circuit, hence it follows, if each lamp's resistance is known once for all, in accordance with ohms law, "The electro motor force in volts divided by the resistance in ohms will give the current strength or amperage, approximately speaking, each sixteen candle-power lamp modifies the current so as to deliver half an ampere, therefore twenty such lamps or ten of thirty-two candle-power each, would give ten amperes, i. e. sufficient current to heat a platinum, German silver, iron or steel wire No. 22 to incandescence.

Cautery handles employed on the 110 volt current must be well constructed and the make and break of the circuit must take place at the bank of lamps, if attempted at the handle by the usual device, internal arcing will occur and the great amount of heat generated soon burn the vulcanite covering and sever the connections so as to unfit them for further usefulness.

For cautery electrodes a small piece of iron wire No. 22, such as book-binders and printers use to secure the leaves of calendars and booklets, variously bent to meet the exigencies of the case requiring treatment, will answer every purpose and the medical electrician will find it much less trying from a pecuniary standpoint than the purchase of platinum electrodes.

For superior x-ray effects from five to ten amperes from the alternating or sinusoidal dynamo, nicely adjusted by a bank of lamps, to the winding of the primary of a large Rhumkorff coil, without a rheotome, but placed in series with a Tesla oscillator and an adjustable vac-

The author experimenting with the bank of lamps properly attached to a large Rhumkorff Coil, soon after the discovery of the X-ray. The Crookes' tube employed is of the first pattern and contains no reflector. It was imported from Germany by his friend, Mr. Edgar B. Stevens, Physicist and Chemist.

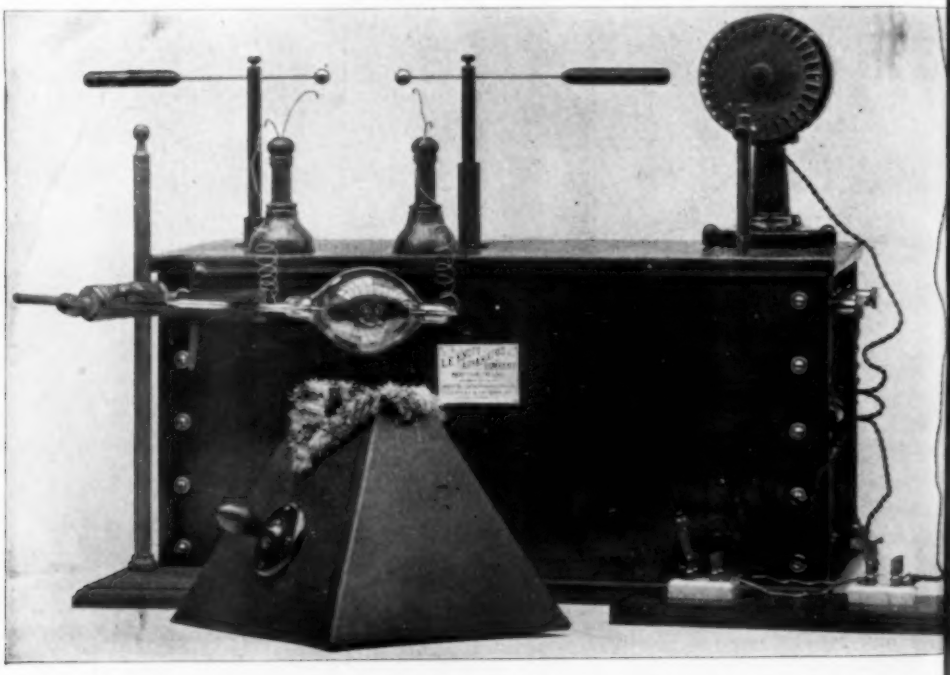
uum, double reflecting Crooke's tube is earnestly recommended to the expert Roentgenian. (See Illustrations.)

The same strength of current from a direct dynamo is best suited to the charging of storage batteries, like poles of the board and battery being attached to each other, positive to positive, etc. The storage battery may be used while thus connected to the dynamo or after it has obtained its charge it can be disconnected and employed in the usual manner. (See Cut No. 4.)

From two to five amperes can be utilized to cause electrolysis of benign or malignant growths, keloid tissue and fibro-plastic exudates.

One-half to one ampere will often cure chronic rheumatism, gout and many other old disabilities of the extremities, strictures of the male urethra and atonic chronic inflammatory uterine diseases.

One-half an ampere applied to the pneumogastrics in the neck will relieve asthma, irregular or purturbed heart's action and atonic dyspepsia, the same strength of current is of great benefit in columnar and functional diseases of the spinal cord also for local medication of any portion of the body by the process of cataphoresis, in fact the manifold purposes for which a mild galvanic current is utilized in modern electro-therapeutics.



Two of the Tesla-Knott Apparatus are attached beyond a bank of lamps on the sinusoidal arc-light circuit.

The galvanic current must, however, always be associated with voltage or pressure sufficient to drive it through the resisting epidermis but not so great as to cause burning or irritation of the exposed parts.

In order to vary the voltage but at the same time maintain a constant amperage it has been my custom to shunt into the current of egress from the bank of lamps and in multiple therewith a home-made coil of No. 28 copper wire, the tota

weight of which is one pound. By tapping this coil at uniform intervals it delivers a current varying in potential from three to fifty volts, the pressure increasing in direct ratio to the length of wire introduced into the shunt.

The faradic induction coil may be attached beyond the board of lamps, one or two of which are turned on and with a varying amount of the resistance coil placed in the circuit, it will furnish the operator many degrees or qualities of induction from which to choose, in order to combat various pathological conditions. Much more could be written, "apropos" upon the importance and utility of A Bank of Lamps, but for the present it

A new Combination Faradic, Galvanic and Cautery Storage Battery, employed to remove Tumors, Unsightly Growths, Marks and Blemishes, and for the Cure of Rheumatism, Paralysis and Nervous Affections. When exhausted it may be re-charged with electricity beyond a bank of lamps.

must suffice to add, that through its proper understanding we are enabled to harness the strong currents of the industrial dynamo and render them subservient to all the requirements of the modern electro-therapeutist. It becomes for him the portal through which he may pass from comparative obscurity with an entailment of filthy, unreliable chemical batteries into the ever expanding field of usefulness made possible by the acquisition of absolute quantities and ample current strength, the most prominent combatant of chronic invalidism.

RESEARCHES BY MEANS OF X-RAYS ON THE ADULTERATION OF FLOUR.

BY A. BLEUNARD.

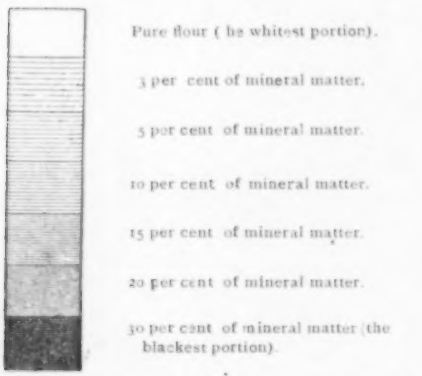
Dr. LaBesse and myself having had occasion to analyze flour containing as much as 40 per cent of foreign mineral matter, have tried to discover this adulteration by means of the x-rays, a research which has been made before, but which we wished to perfect and make as sensitive as possible. The nature of the mineral substances present in the flour, consisting of sand reduced to a powder, and insoluble lime salts, principally chalk, we decided a priori to look upon our experiment as one that could be easily performed successfully. The experiment was a complete success when the conditions exist as indicated below.

It is claimed to be difficult to compare the shades when they have great variation, and this is why, in the improvement made by Faucault on the Bouguer photometer, this scientist has obliterated all black or luminous lines, due to the separating screen between the two luminous sources to be compared. We thought of operating in the same manner and to superimpose, on the photographic plate or the fluorescent screen, without discontinuity, the two images of the flour to be compared, pure flour on one side and adulterated flour on the other. To this simple arrangement we owe all the sensitiveness of our method.

We placed on an ordinary photographic plate of gelatine-bromure, a small pasteboard box, of rectangular shape, from which the top and bottom are removed, retaining consequently only the lateral walls, of about one centimetre in height. We divided the box into two equal parts, by means of a small rectangle of convenient dimensions, cut from a visiting card. This done, we then filled one of the compartments with the pure flour, the other with the

adulterated flour; we removed with precaution the separating partition, and we lightly tapped the box with the finger so as to fill up the small empty space which fills with flour, without sensible mixture. The whole is covered with a sheet of tin foil, with a quite narrow rectangular slit cut in it, and placed perpendicular to the section of separation between the two flours. It only remains to expose it to the action of the x-rays and to disclose the image.

The duration of exposure must not be too long, and naturally depends on the apparatus one employs. Two minutes was sufficient for that which we experimented with. Too long an exposure


Pure flour (the whitest portion).
3 per cent of mineral matter.
5 per cent of mineral matter.
10 per cent of mineral matter.
15 per cent of mineral matter.
20 per cent of mineral matter.
30 per cent of mineral matter (the blackest portion).

SCALE OF TINTS SHOWING THE ADULTERATION OF FLOUR.

has the disadvantage of producing too dark tints, the comparison of which is impossible; too short an exposure produces, on the contrary, too faint tints.

This method has permitted us to disclose with certainty the presence of three per cent of foreign mineral matter in flour, this matter being composed of equal weights of very fine sand and chalk. The adulteration can be detected much easier when the proportion of mineral matter is greater.

Besides, it is possible, once the fraud is known, to tell with considerable exactness the quantity of mineral matter introduced. It suffices to compare the tint obtained with an increasing scale of tints, obtained by introducing into pure flour known quantities of foreign mineral matter. We further wish to remark that the tints vary with the nature of the mineral matter employed in the adulteration, and that this method of quantitative analysis can only be approximate. The accompanying engraving is an exact reproduction of a scale of increasing tints, obtained by placing in succession, in the same kind of a box and using the above precautions, successive samples of pure flour and of flour progressively mixed with mineral matter, such as sand and chalk.—*La Nature.*

PHOTOGRAPHING THOUGHT.—It is said that Thomas Edison, Jr., can photograph thought. Certainly. Nothing is easier. The world moves.

In New York a short time ago in a parlor of a hotel, a stranger told the company if some of them would think of anything and no one but the individual know what it was, he would tell what it was and he did not fail once. A plane was charged with the thought and his intuitive sense knew what it was.

Last Fall in Western Pennsylvania, a plane was shown that had been charged nearly twenty years with the appearance of a man imprinted on a plate, and all knew the picture. If a plane charged with a thought reaches a sensitive plate, that thought will be imprinted on the plate.

Probably by the use of these planes the artist will in the near future be able to take pictures of the inhabitants of the planets and sun. Already have people through these planes and the intuitive sense (clairvoyant) discovered that they are inhabited, and described some of the people. There is no end to progression in this life or the next. The only similarity of this to the x-ray is they both use these planes, only different ones.—*Philosophical Journal.*

THE APPLICATION OF ROENTGEN RAYS TO MEDICAL DIAGNOSIS.

Abstract of paper read before the Section on Practice of Medicine at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia Pa., June 1-4, 1897

BY CHARLES LESTER LEONARD, A. M., M. D.
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The application of the Roentgen rays to medical science has already given to surgery a method of diagnosis the precision of which makes it of the greatest value; this value lies in the absolute pictures which we are able to secure by its means, and loses its pre-eminence as soon as we are compelled to substitute for the absolute picture in black and white, mental pictures which always involve the personal equation of the observer.

It is worse than useless to suppose that any new method of forming mental pictures, no matter how startling or radical, can equal in accuracy or approach in value those which the science of medical diagnosis has already taught us to form, with well-nigh infallible precision. It would be supererogation on the part of any one to think that the mental pictures which he might form by the use of the Roentgen rays could replace or add to the pictures which modern physical diagnosis is capable of presenting.

The property which gives this new method of diagnosis its greatest value and helps it to add to the sum of our knowledge, is its power to form real images, to make tangible shadows where only mental pictures were before possible. These tangible shadows eliminate the personal equation of the observer from the resulting diagnosis, and thus remove a source of error common to all methods that depend on the senses of the individual for the accuracy of their results. To this advantage is added the fact that they produce permanent data which different individuals may study in various stages of the same case or compare with other cases.

The true value of the Roentgen rays and the advance made in their adaptation to medical diagnosis must be judged by the advance in our ability to replace or confirm by skiagraphs the mental images obtained by other methods. In cases where the lesion is extensive, where the symptoms and physical signs are pronounced, the skiagraph may only confirm the diagnosis, adding perhaps a few facts as to the exact shape of an aneurism or the extent of the diseased area. It is, however, in the early stages of disease during its inception, that it aids, chiefly by establishing a diagnosis which our most careful means of physical examination fail to make certain. This it does by differentiating between different areas of dullness, which by other methods present identical physical signs.

The application of this method to medical diagnosis is far more difficult than its application to surgery, for here we must deal with the relative opacities or structures which vary from one another by only slight degrees. To make this possible, the varying qualities of the x-ray must be under the control of the operator, so that he may employ more or less penetration as he may desire, and use at will the x^1, x^2 or x^3 rays. The results already attained in medical diagnosis are perhaps not as practical as those in surgery, but the possibilities which they open up are so great that this first insight gives promise of a future development of even greater value than in surgery.

After presenting skiagraphs which showed the entire trunk and upper extremities of a normal 5-year-old boy and the thorax of an adult male, the author draws a comparison between them and a series of skiagraphs of aortic aneurism. The series of intra-thoracic aneurisms illustrates the accuracy with which we

may depict their extent and form, even in portions that are too deeply situated to permit of their difinite determination by percussion, or in aneurisms so small that their existence would be difficult to determine by other means of diagnosis. It is in the cases where our diagnosis is most wanting that the skiagraph gives the greatest aid, and differentiates between small aneursims of the aorta and mediastinal tumors. In a case where the symptoms and physical signs were not sufficiently distinct to warrant a diagnosis of aneurism and might have been accounted for by a spasmodic irritation, an asthmatic attack or some disturbance of the circulation, the skiagraph decided the question and the area of dullness, which might have been due to tuberculosis of the mediastinal glands as was the case in one instance studied, was found to be due to a deep-seated small aneurism. The relative opacity of tubercular glands in the mediastinum has been shown to be less than that of aneurisms.

Although deprecating the prominence which some would give to fluoroscopic diagnosis, the author realizes its possibilities and has confirmed by personal observation the results obtained by others. He believes, however, that its greatest usefulness is in the detection and study of motion, either normal or pathologic, in organs whose motion is beyond the field of ordinary vision. In the study of aneurisms and their pathological expansile motion as observed by the fluoroscope, there is, therefore, a definite addition to our knowledge. The author showed in addition skiagraphs of aneurism of the innominate artery, marked dilatation and hypertrophy of the heart and the condition within the thorax resulting from empyema and thoracotomy. By washing out the stomach and subsequently introducing an emulsion of bismuth in a case of gastroptosis, he was enabled to show the area of the stomach through the bones of the pelvis.

THE X-RAY IN MEDICINE AND SURGERY. *Medical Review of Reviews*, Feb. 25, 1898. —Dr. Samuel Lloyd, of New York, discussed the question of apparatus. He said that excellent results were obtained with the static machine, and that the physician already using static electricity would find that he required but few and comparatively inexpensive additions to enable him to carry on x-ray work. But there was the same unreliability about this method of generating the x-rays that there was about all static machines, and for this reason many preferred an induction apparatus. An important point in the technique was that the intensity of the x-ray should be adapted to the special case under examination.

Dr. Francis H. Williams, of Boston, gave an interesting discourse on the use of the x-ray in medicine. He said that for this kind of work the apparatus must be of the very best. To those who have not followed this branch of the subject, the wide range of usefulness of the x-ray in medicine comes as a sort of revelation. Dr. Williams detailed cases in which months before the physical signs, as usually obtained, indicated tuberculous involvement of the lungs, he had been able by means of an x-ray examination to detect evidences of such a disease process. He showed photographs in proof of his statement that in pneumonia the affected areas of the lung could be readily distinguished by the fluoroscope. The chief points noted by fluoroscopic examination of the thorax are: (1) the presence of dark areas in tuberculosis, pneumonia, carcinoma, gangrene of the lung, infarction, pleurisy, and empyema; (2) the occurrence of abnormal brightness in emphysema and pneumothorax; and (3) restriction of the excursions of the diaphragm, and the altered position of the latter.

Dr. Arthur L. Fisk, of New York, and William Hailes, of Albany, completed

the presentation of this subject by a lantern exhibition of what had been actually accomplished by aid of the x-rays.

Bismuth Capsules.

BUFFALO, N. Y. Feb. 21, 1898.

TO THE EDITOR:—In your issue of February 19, you quote from a report of Boas and Dorn, in the *Deutsche Med. Woch.*, regarding the use of capsules of bismuth for location of lesions in the alimentary tract. As this is an important matter, in regard to which priority is, naturally, a matter of interest, will you kindly put on record the following data:

Feb. 9, 1897, I used gelatin capsules containing reduced iron for this general purpose, having had the matter in mind for some months. This experiment was a failure, on account of a lack of power of x-ray apparatus, so far as the stomach was concerned, though the capsules could be plainly seen in the mouth. July 13, 1897, this method succeeded with three or four patients, using both iron and bismuth in the capsules. These experiments are more fully reported in *Medicine*, February, 1898.

Very truly,

A. L. BENEDICT, M. D.

The Journal of the American Medical Association., March 5, 1898.

FOREIGN BODIES IN THE ESOPHAGUS.—At a meeting of the Paris Societe Medicale de Hopitaux (*La. Med. mod.*, VIII, No. 94, p. 752) Dr. Variot reported a case of a child who when ten months old swallowed a small metallic plate (2-5 by 1-5 inch in diameter) while playing with a rattle in his mouth. This foreign body remained imbedded in the esophagus for a year, when it finally came out by a violent fit of coughing.

During all that time the child had occasional fits of coughing, slight dyspnea, and could take nothing but milk; bouillon and eggs he could not swallow. Another case reported by the same author was that of an infant eight months old, who swallowed an O'Dwyer tube. It gave rise to no disorders, but the x-rays showed that it was imbedded in the duodenum. At the same meeting Dr. Rendu reported the case of a boy of ten years who swallowed a coin, which, as the skiagrams showed, became arrested at the middle of the esophagus. The only symptoms were occasional attacks of cough and dyspnea.—*Pediatrics.*

ROENTGEN'S discovery is daily applied to fresh purposes. Radiography has now become really practical. The use of the fluorescent screen, which is becoming more and more general, supplies a new method of clinical investigation, which already renders undoubted service and from which yet greater results can be expected. Anatomy, surgery, medicine, have abundantly profited recently by the new rays. They also seem likely to be employed with advantage in therapeutics.

M. Pean has utilized the Roentgen rays to determine the position of a coin swallowed by a child. He drew special attention to the difficulty of recognizing the presence of foreign bodies by the usual methods when children continue to imbibe liquids and do not complain of any pain. Their frail limbs and delicate bodies are easily traversed, and the osseous parts being nearer to the screen which receives the projection, the result is that the image is smaller, clearer, and more close to nature.—*Journal of Electro Therapeutics.*—March, 1898.

MM. E. DESTOT and L. Berard, of Lyons, by combining the use of the Roentgen rays with that of the stereoscope, have succeeded by a logically calculated system of metallic injections in throwing light upon the points hitherto obscure in the circulation of various organs.—*Journal of Electro Therapeutics*, March, 1898.

Progress Comes Only By Improvement.

In the treatment of pneumonia, in addition to an antipyretic, we must have an analgesic. Garofen is both an antipyretic and analgesic; and thus reduces the fever, relieves the pain, and quiets the restlessness so often seen.

The most thorough and careful clinical tests, both in health and disease, by some of the most brilliant men in the medical profession, have established beyond all doubt the value of Garofen as an analgesic and antipyretic. Added to this is the unprecedented and almost unexpected unanimity in the verdict of those who have and are using it. Letters of recommendation and testimonials, unsolicited, have come from all quarters, and that among them should not be a single criticism or complaint, seems almost incredible.

It is absolutely non-poisonous, and in every way reliable.

"The physicians of Missouri, Illinois, Arkansas and Texas are to be congratulated that St. Louis offers them in the St. Louis Physician's Supply Company, a house where they can get their drugs, instruments, tablets, fluid extracts, and surgical sundries. This house tries to fill all the wants of a physician. The president of the company, and also manager, is an experienced druggist, and superintends the manufacture of their specialties for physicians, for which they have a large sale among them.

"To the country doctor, who furnishes his own medicines, they are just the thing, being palatable, reliable and cheaper than the many proprietary remedies advertised.

"Their 'Quina Lyptus,' advertised on page x will no doubt have a large sale during the coming chill and fever months."

The recent circular on "X-rays and Electro-Therapeutics" issued by the L. E. Knott Apparatus Co., is worthy of careful inspection. Physicians who are looking for an effective outfit which will combine the advantages of an x-ray and electro-therapeutic generator will be interestedin the instrument there described.

Diphtheria and Diphtheritic Sore Throat.—Campho-Phenique, in the form of a spray is superior to all other remedies "—Drs. Collingham and Melton, Aurora, Mo. "I find Campho-Phenique remarkably effective in diphtheria and diphtheritic sore throat, used as a spray."—Dr. L. A. Roth, Springs Forge, Pa. "Campho-Phenique well diluted, and used as a spray, has great energy and effect in diphtheritic sore throat." F. H. Lutterbeck, Anthony, N. M. "I have met with such excellent results with it in the treatment of diphtheria that I would not undertake to treat a case without it. My formula is: Campho-Phenique, two parts; water, two parts; mistura acacia, four parts. Suspend the Campho-Phenique, in the mixture and apply with a probang,"—Dr. John E. Pritchard, No. 1010 Chesapeake St., Baltimore, Md.

Polk's Medical and Surgical Register of the United States and Canada is now undergoing its fifth revision. Physicians who have not given their names to the canvassers are urged to report to headquarters at once, giving full information. Address, R. L. Polk & Co., Detroit, Mich.

Pain in Otitis.—Dr. George H. Powers, Professor of Ophthalmology and Otology in the University of California, San Francisco, in an article in *The Medical News*, writes as follows, inreference to the treatment of pain in otitis: "At my first visit I found a copious discharge of bloody serum from the ear with hardly a trace of pus. He suffered from severe cephalalgia, but there was no special tenderness in or about the ear, and no swell-

ing. Thorough cleansing of the meatus with dry cotton relieved the pain in the head remarkably, and with a dose of antikamnia, 10 grains, he slept some hours."

Garofen In Malarial Fever.

From Garofen I obtained full analgesic and antipyretic effect claimed for the agent. In malarial fevers, which are very prevalent in this district, produces the happiest effects. It reduced fever without the excessive sweats that the coal-tar group do, and it does not depress the heart's action as they do. As a pain reliever I consider it superior to any of the coal-tar products. I well remember a child whose fever and pain could not be relieved until Garofen was prescribed. F. R. WHEELER, M. D. Stottsville, Ark.

SOME of the prepared foods are advertised in newspapers and circulars on the cure all and "Save the doctor bill" plan. We have noticed some of their advertisements wherein the wonderful properties of the foods are extolled as cures for a long list of diseases. The Imperial Granum Food, however, is advertised only in the medical press and is sold only through the recommendation of the profession. It deserves the support of physicians on this account therefore, as well as for its merits as an ideal prepared food.—*The Wisconsin Medical Recorder*, February, 1898

THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.

A handbook of plain instructions for the general practitioner. By S. H. Monell, M. D., Brooklyn, N. Y. Published by William Beverly Harison, 3 and 5 West 18th Street, New York. 1088 pages.

Another extremely valuable work on electro-therapeutics has been launched by the same author as the recent publication, "Manual of Static Electricity in X-Ray and Therapeutic Uses," which has attracted world-wide reputation thus early for its clearness of description, and usefulness to the general practitioner.

It would be impossible for us to specialize the headings of the 70 chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic and static electricity and their therapeutic indications are detailed in this volume with conciseness of language and minute directness of application, so that the general practitioner may read and understand.

Probably no book on electro-therapeutics, and we say it conservatively, has ever equaled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries.—*Medical Times and Register*, Phila., Pa., January, 1898.

Manual of Static Electricity in X-Ray and Therapeutic Uses. $6 00

Treatment of Disease by Electric Currents. $7.50

Eureka Springs, Ark.,

As a summer and winter resort cannot be surpassed. To this famous all-year-round resort round-trip tickets are on sale from all principal cities throughout the country at greatly reduced rates.

Double daily trains from St. Louis. A neat little pamphlet giving detailed description of Eureka Springs will be mailed free upon application to GEO. T. NICHOLSON, Gen'l Pass. Ag't., Frisco Line, St. Louis, Mo.

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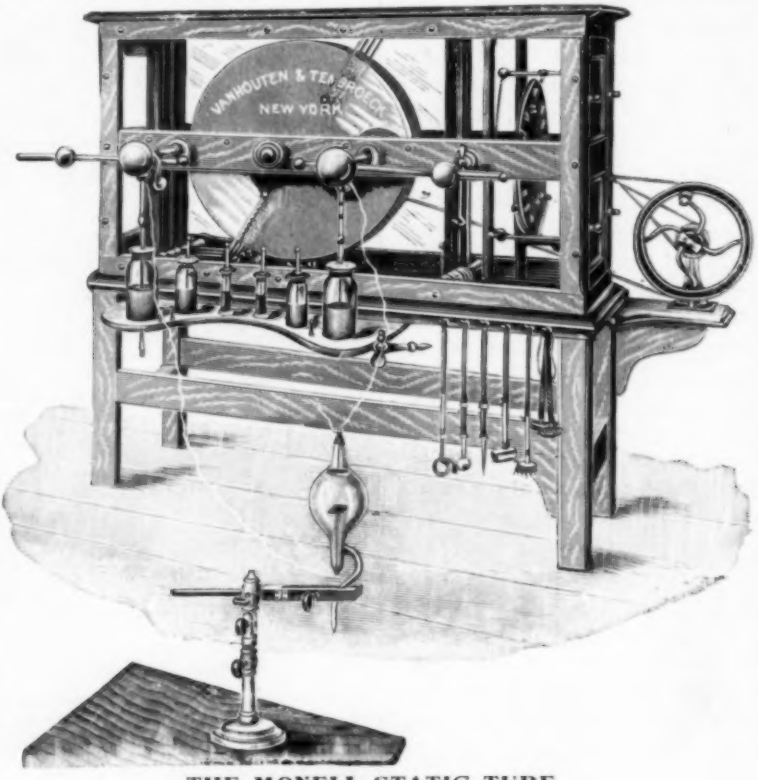

BEST IN THE WORLD

THE MONELL STATIC TUBE.

ST LOUIS, MO., Jan'y 16, 1898.

VAN HOUTEN & TEN BROECK,
New York.

GENTLEMEN:—The machine is a model of *mechanical skill*, and is a source of constant delight and admiration to those who have seen it. Those who have experienced its *potency* in disease, are loud in its praise, and as for myself, there is no one agent in the whole realm of scientific medicine, that gives me so much satisfaction in its employment, as does Static electricity.

The tube you sent with the machine, has developed into one of high efficiency. Heart pulsations are plainly seen, and objects such as a watch-key, tin horse-shoe and star, such as found on "Horse-Shoe" and "Star" tobacco, are plainly visible through a ½ inch pine board, at a distance of about 28 feet. My friend Dr. . . . . witnessed this tube in operation January 13th, and he confesses that he had never seen X-radiance before, such as was shown with my 8-plate machine, and Monell tube. I will say that Dr. . . . . is one of a committee appointed by the Faculty of the . . . Medical College to buy an X-Ray outfit, and he came to my office predisposed in favor of a coil.

I think there is now but little doubt that he will favor a Static machine.

I beg to remain very truly yours,

WM. W. GRAVES, M. D.

VAN HOUTEN & TEN BROECK, 300 Fourth Avenue, NEW YORK.

Makers of High Grade Electro-Therapeutical Apparatus.